Remarks

Support for the above-requested amendments to claim 1 is found at least in paragraph [0020] and Figures 4 and 5. Claim 9 has been amended to change the phraseology to further describe the nano-clays. Support for the amendments to claim 21 is found at least in paragraph [0010] and Example 1. Support for the amendments to claim 24 is found at least in paragraphs [0009] and [0010].

Claims 1 – 16 and 21 - 24 are before the Office for consideration.

Rejection of Claims 1 - 8, 14, 16 and 21 - 23 under 35 U.S.C. §102(e)

The Office has rejected claims 1 - 8, 14, and 16 - 23 under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 6,696,504 to Hayashi *et al.* ("Hayashi"). In particular, the Office asserts that Hayashi teaches a method of manufacturing a rigid foam by incorporating nano-particles into a polymer melt, incorporating a blowing agent into the melt, extruding the polymer melt, and cooling the foamed product formed.

Initially, Applicants note that claims 17 - 20 were canceled in the previous response. As a result, Applicants submit that these claims are no longer before the Office for consideration. Therefore, Applicants respectfully submit that the rejection of claims 17 - 20 is moot.

In response to the rejection, Applicants respectfully direct the Office's attention to the amendments to claims 1 and 21 and submit that independent claims 1 and 21, as amended, define methods of manufacturing a rigid foam that are not taught within Hayashi. Hayashi teaches an extruded polystyrene resin foam and a method of making such a foam where the cells constituting the foam comprise mainly smaller cells having a cell size of 0.25 mm or less, and larger cells having a cell size of 0.3 to 1 mm. (*See, e.g.*, column 3, lines 21 – 25;

column 4, lines 16 – 21; column 12, lines 19 – 23; column 16, lines 19 – 22; and claim 5). The area of the smaller cells (*i.e.*, a cell size of 0.25 mm or less) accounts for 10 – 90% of a sectional area of the foam. (*See, e.g.*, column 3, lines 25 – 27 and column 4, lines 21 – 23). It is preferred that the larger cells have a cell size of about 0.4 – 0.7 mm. (*See, e.g.*, column 12, lines 53 – 54). In addition, it is preferred that the cells having a cell size of not more than about 0.25 mm and the cells having a cell size of about 0.3 – 1 mm are dispersed as uniformly as possible to impart a low thermal conductivity and an adequate bonding strength to the foam. (*See, e.g.*, column 12, lines 41 – 47).

Applicants respectfully submit that Hayashi teaches the manufacture of a foam with a bi-modal cell distribution, and that there is no teaching within Hayashi of a foam having a monomodal cell size distribution as claimed in amended claims 1 and 21. In order for a reference to be anticipatory, each and every element of the claimed invention must be found within the four corners of the cited reference. Because Hayashi does not teach a monomodal cell size distribution as required by claims 1 and 21, Applicants submit that Hayashi is not an anticipatory reference. Therefore, Applicants submit that claims 1 and 21 are not anticipated by Hayashi.

With respect to dependent claims 2 – 16, Applicants submit that because independent claim 1 is not taught within Hayashi (as discussed *supra*) and claims 2 – 16 are dependent upon independent claim 1 and contain the same elements as claim 1, dependent claims 2 – 16 are also not taught by Hayashi. Similarly, Applicants submit that because independent claim 21 is not taught by Hayashi (as discussed above), and because claims 22 – 23 are dependent upon independent claim 21 and contain the same elements as claim 21, dependent claims 22 – 23 are also not taught by Hayashi.

In view of the above, Applicants submit that claims 1 - 8, 14, and 16, and 21 - 23 are not anticipated by Hayashi and respectfully request reconsideration and withdrawal of this rejection.

Rejection of Claims 1 - 14 and 16 under 35 U.S.C. §102(e)

The Office has rejected claims 1 - 14 and 16 - 20 under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 6,759,446 to Lee *et al.* ("Lee"). In particular, the Office asserts that Lee teaches incorporating nano-particles of nano-clays to produce a foam with an average cell size being greater than approximately 60 μm.

Initially, Applicants note that claims 17 - 20 were canceled in the previous response. As a result, Applicants submit that these claims are no longer before the Office for consideration. Therefore, Applicants respectfully submit that the rejection of claims 17 - 20 is moot.

Applicants respectfully traverse this rejection in view of the following remarks.

In the Office Action, it is asserted that Lee teaches a cell size greater than approximately 60 μm in claim 10 (*see*, column 12, lines 9 – 11), and, as a result, anticipates claim 1. In particular, claim 10 recites that the "polymeric nanocomposite foam has an average cell size greater than about 15 microns." (*Id.*). However, when analyzing the enabled scope of a claim, "the teachings of the specification must not be ignored because claims are to be given their broadest reasonable interpretation that is consistent with the specification." (*See Manual of Patent Examining Procedure*, Patent Publishing, LLC, Eighth Ed., Rev. 3, August 2005, §2164.08).

Lee specifically teaches that by controlling the carbon dioxide content, the melt and die temperatures, and pressure drop rate, a microcellular foam is formed that has a very high

Lee also teaches that it is preferred that the polymeric nanocomposite foam has an average cell size less than about 20 μm and greater than about 15 μm. (*See, e.g.*, column 3, lines 31 - 35 and column 4, lines 24 - 28). In column 7, lines 48 – 60, in the preferred embodiment of the invention , the calculated cell size was 4.9 μm. Thus, in view of the teachings set forth in Lee and the procedural rules set forth in MPEP §2164.08, claim 10 must be interpreted as a polymeric nanocomposite having a cell size between about 15 μm and less than about 20 μm, and cannot be interpreted to encompass a cell size of 60 μm or greater as is claimed in claim 1.

In view of the above, there is no teaching within the four corners of Lee of a method of making a foam product that has an average cell size greater than about 60 μm with a monomodal cell size distribution as presently claimed in claim 1. As previously discussed, to be an anticipatory reference, each and every element of the claimed invention must be found within the four corners of the cited reference. Because Lee does not teach or suggest a method of making a rigid polymer foam having an average cell size greater than approximately 60 μm with a monomodal cell size distribution as required by independent claim 1, Applicants submit that claim 1, and all claims dependent therefrom, are not anticipated by Lee.

In light of the above, Applicants submit that claims 1 - 14 and 16 are not anticipated by Lee and respectfully request that this rejection be reconsidered and withdrawn.

Rejection of Claim 15 under 35 U.S.C. §103(a)

The Office has rejected claim 15 under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,696,504 to Hayashi *et al.* ("Hayashi") in view of U.S. Patent No. 6,759,446

to Lee *et al.* ("Lee"). In particular, the Office asserts that Hayashi teaches a cell orientation between about 1.0 and about 1.5 and a foam density between about 20 and about 50 kg/m^3. It is admitted that Hayashi does not teach a cell size between about 60 and 120 μm. The Office further asserts that Lee teaches a foam with an average cell size greater than 15 μm, alleging that several figures of Lee visually appear to meet the limitations of cell wall thickness and cell strut diameter. In view of the above, it is concluded that it would have been obvious to one of skill in the art to produce a foam with the properties of claim 15 using the combined teachings of Hayashi and Lee.

In response to this rejection, Applicants respectfully direct the Office's attention to independent claim 1 and submit that claim 1, as amended, defines a method of manufacturing a rigid foam that is not taught or suggested within Hayashi and Lee, either alone or in combination. Initially, Applicants submit that Hayashi does not teach or suggest a polymeric foam having a monomodal cell size distribution as claimed in amended claim 1. As discussed in detail above, Hayashi teaches an extruded polystyrene resin foam and a method of making such a foam where the cells constituting the foam comprise mainly smaller cells having a cell size of 0.25 mm or less, and larger cells having a cell size of 0.3 to 1 mm. (*See, e.g.*, column 3, lines 21 – 25; column 4, lines 16 – 21; column 12, lines 19 – 23; column 16, lines 19 – 22; and claim 5). It is clear from these descriptions in Hayashi that Hayashi teaches a method in which a foam with a bi-modal cell size distribution is formed. This is vastly different from the method currently recited in claim 1 in which a foam product is produced that has a monomodal cell size distribution and an average cell size greater than approximately 60 μm. In fact, Applicants submit that the bi-modal cell size distribution taught by Hayashi teaches away from the monomodal cell size distribution of the present invention as claimed in amended claim 1.

In addition, Applicants submit that there is no motivation for one of skill in the art to arrive at the invention currently recited in claim 1 based on the teachings of Hayashi. To establish a *prima facie* case of obviousness, there must be some motivation, either within the reference or in the knowledge of those of skill in the art, to modify the reference or combine the references' teachings, there must be a reasonable expectation of success, and the prior art references must meet all of the claim limitations. (*See, e.g., Manual of Patent Examining Procedure*, Patent Publishing, LLC, Eighth Ed., Rev. 3, August 2005, §2142). One of skill in the art simply would not be motivated to arrive at the presently claimed method of manufacturing a rigid foam that includes the steps of (1) incorporating nano-particles into a polymer melt, (2) adding a blowing agent to the polymer melt under a first pressure and at a first temperature, (3) extruding the polymer melt under a second pressure and at a second temperature sufficient to allow the polymer melt to expand and form a foam, and (4) cooling the foam to form a foam product that has a monomodal cell size distribution as recited in amended claim 1. Hayashi specifically teaches a bi-modal cell size distribution. Without some teaching or suggestion, there can be no motivation, and without motivation, there can be no *prima facie* case of obviousness.

In addition, Applicants respectfully submit that Lee does not teach or suggest the method defined by amended claim 1. Lee teaches a polymeric nanocomposite foam that has an average cell size less than about 20 μm and greater than about 15 μm. (*See, e.g.*, column 3, lines 31 - 35 and column 4, lines 24 - 28). As such, Lee teaches a preferred average cell size of between about 15 μm and about 20 μm. Lee also teaches that by controlling the carbon dioxide content, the melt and die temperatures, and pressure drop rate, a microcellular foam is formed that has a very high cell density (*i.e.*, $>10^9$ cells/cm^3) and a small cell size (*i.e.*, < 5 μm). (*See, e.g.*, Abstract). As discussed above, in view of the teachings set forth in

Lee and the procedural rules set forth in MPEP §2164.08, claim 10 must be interpreted as a polymeric nanocomposite having a cell size between about 15 μm and less than about 20 μm, and, therefore, cannot be interpreted so as to encompass a cell size of 60 μm or greater as recited in claim 1. Applicants further submit that these teachings of Lee would lead one ordinarily skilled in the art away from a method of manufacturing a rigid foam that includes incorporating nano-particles into a polymer melt, incorporating a blowing agent into the polymer melt under a first pressure and at a first temperature, extruding the polymer melt under a second pressure and at a second temperature sufficient to allow the polymer melt to expand and form a foam, and cooling the foam to form a foam product having an average cell size greater than 60 μm as claimed in claim 1.

As discussed previously, to establish a *prima facie* case of obviousness, there must be some motivation, either within the reference or in the knowledge of those of skill in the art, to modify the reference or combine the references' teachings, there must be a reasonable expectation of success, and the prior art references must meet all of the claim limitations. One of ordinary skill in the art simply would not be motivated to arrive at the presently claimed method which produces a foam having an average cell size greater than 60 μm by reading the disclosure of Lee. Without motivation, there cannot be a *prima facie* case of obviousness.

In light of the above, it is clear that neither Hayashi nor Lee teach or suggest the invention claimed in claim 1. Additionally, Applicants submit that Hayashi and Lee in combination do not teach or suggest the invention as claimed in claim 1. If Hayashi were combined with Lee as suggested by the Office, the result would be a method of making a polymer foam in which the polymer foam had a bi-modal cell size distribution and a cell size

of less than about 20 μm. Applicants therefore submit that the combination of the cited references would not result in the presently claimed invention as recited in claim 1.

Because claim 15 is ultimately dependent upon claim 1, which, as discussed above, is not taught or suggested within Hayashi and/or Lee, Applicants submit that claim 15 is also not taught or suggested within Hayashi and/or Lee. As such, Applicants submit that claim 15 is non-obvious and patentable and respectfully request that the Office reconsider and withdraw this rejection.

Rejection of Claim 24 under 35 U.S.C. §103(a)

The Office has rejected claim 24 under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,759,446 to Lee *et al.* ("Lee"). In particular, the Office asserts that Lee teaches a method of manufacturing a rigid foam by incorporating nano-particles into a polymer melt, incorporating a blowing agent into the melt, extruding the polymer melt, and cooling the foamed product formed to form a foam product having an average cell size between about 60 and 120 μm. Specifically, it is asserted that Lee teaches a method of manufacturing a foam with an average cell size greater than 15 μm.

In response to this rejection, Applicants respectfully direct the Office's attention to independent claim 24 and submit that claim 24, as amended, defines a method of manufacturing a rigid foam that is not taught or suggested within Lee. Lee teaches a method of forming a polymeric foam that includes a step of providing a mixture of a polymer, an organophilic clay, and a blowing agent. (*See, e.g.*, column 2, lines 30 – 33 and claims 1 and 2). Although any desired amount of organophilic clay may be used, it is preferred that the mixture contain at least 0.5% by weight. (*See, e.g.*, column 2, lines 43 – 45 and column 7,

lines 13 – 14). It is preferred that the organophilic clay is a smectite clay. (*See, e.g.*, column 2, lines 66 – 67; column 3, lines 20 – 21; and claims 6 and 8).

Applicants respectfully submit that there is no teaching or suggestion within Lee of a method of manufacturing a rigid foam that includes the step of incorporating nano-particles that are calcium carbonate, an intercalcated graphite, and/or an expanded graphite into a polymer melt as required by amended claim 24. As discussed above, Lee teaches utilizing an organophilic clay in the method of forming a polymeric foam. There is simply no teaching or suggestion anywhere within Lee of incorporating calcium carbonate, intercalcated graphite, and/or expanded graphite nano-particles to form a polymeric foam. Lee therefore fails to teach or suggest the method recited in amended claim 24, namely, a method of manufacturing a rigid foam that includes the steps of (1) incorporating nano-particles into a polymer melt where the nano-particles are calcium carbonate, intercalcated graphite, and/or expanded graphite, (2) adding a blowing agent to the polymer melt under a first pressure and at a first temperature, (3) extruding the polymer melt under a second pressure and at a second temperature sufficient to allow the polymer melt to expand and form a foam, and (4) cooling the foam to form a foam product that has an average cell size greater than about 60 μm.

Further, Applicants submit that Lee teaches away from utilizing calcium carbonate, intercalcated graphite, and/or expanded graphite nano-particles to form a polymeric foam. As discussed above, Lee specifically teaches the inclusion of an organophilic clay and is silent as to the possible inclusion of any other agent. Therefore, Applicants submit that the teachings set forth in Lee would lead one of skill in the art away from the method recited in amended claim 24.

In addition, Applicants respectfully submit that there is no motivation for one of skill in the art to arrive at the invention claimed in amended claim 24 based on the teachings of

Lee. As discussed above, to establish a *prima facie* case of obviousness, there must be some motivation, either within the reference or in the knowledge of those of skill in the art, to modify the reference or combine the references' teachings, there must be a reasonable expectation of success, and the prior art references must meet all of the claim limitations. One of ordinary skill in the art simply would not be motivated to form a rigid foam by incorporating nano-particles into a polymer melt where the nano-particles are calcium carbonate, intercalcated graphite, and/or expanded graphite based on the disclosure set forth in Lee.

In view of the above, Applicants submit that claim 24 is non-obvious and patentable and respectfully request reconsideration and withdrawal of this rejection.

Conclusion

In light of the above, Applicants believe that this application is now in condition for allowance and therefore request favorable consideration.

If any points remain in issue which the Office feels may be best resolved through a personal or telephone interview, the Office is kindly requested to contact the undersigned at the telephone number listed below.

Application No. 10/722,929
Attorney Docket No: 25226A

If necessary, the Commissioner is hereby authorized to charge payment or credit any overpayment to Deposit Account No. 50-0568 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

Date: 4/25/06

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